

Surgical Education

# Assessment of technical and nontechnical skills in surgical residents



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## KEYWORDS:

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## Abstract

**BACKGROUND:** Surgical competence encompasses both technical and nontechnical skills. This study seeks to evaluate the validity evidence for a comprehensive surgical skills examination and to examine the relationship between technical and nontechnical skills.

**METHODS:** Six examination stations assessing both technical and nontechnical skills, conducted yearly for surgical trainees (n = 120) between 2010 and 2014 are included.

**RESULTS:** The assessment tools demonstrated acceptable internal consistency. Interstation reliability for technical skills was low (alpha = .39). Interstation reliability for the nontechnical skills was lower (alpha range -.05 to .31). Nontechnical skills domains were strongly correlated, ranging from  $r = .65, P < .001$  to  $.86, P < .001$ . The associations between nontechnical and technical skills were inconsistent, ranging from poor ( $r = -.06; P = .54$ ) to moderate ( $r = .45; P < .001$ ).

**CONCLUSIONS:** Multiple samplings of integrated technical and nontechnical skills are necessary to assess overall surgical competency.

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To attain competence, surgeons in training must develop both technical and nontechnical skills such as professionalism, communication, and collaboration skills. Although the need for competence in technical skills for surgical trainees is self-evident, competence in nontechnical skills is

now increasingly recognized as an important aspect of patient safety.<sup>1-5</sup>

The need for trainees to attain both technical and nontechnical skills is made explicit by frameworks such as the Canadian Medical Education Directive for Specialists (CanMEDS)<sup>6,7</sup> from the Royal College of Physicians and Surgeons of Canada and the Accreditation Council for Graduate Medical Education Outcome Project.<sup>8</sup> The CanMEDS framework describes for specialist physicians 7 competencies that are needed for the delivery of improved patient outcomes: medical expert; communicator; professional; collaborator; manager and/or leader; health advocate; and scholar.<sup>6,7</sup> These competencies have been integrated into accreditation standards, objectives of training, final in-training evaluations,

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examination blueprints, and the maintenance of certification programs. Postgraduate training programs in Canada are expected to teach and evaluate these CanMEDs roles. Similar competencies are identified by the Accreditation Council for Graduate Medical Education in the United States: patient care; medical knowledge; practice based learning and improvement; interpersonal and communication skills; professionalism; and systems based practice.<sup>8</sup>

To objectively assess for competence in technical and nontechnical skills, direct observation is needed.<sup>9</sup> To assess for a resident's "ability to handle all job-related task,"<sup>10</sup> such as that which mirrors the complexities of teamwork, communication, and professionalism that exists in real-life settings, concurrent assessment of both technical and nontechnical skills is critical. The advent of simulation facilitates directly observed structured assessments of both technical and nontechnical skills.<sup>11,12</sup> However, the relationship between technical and nontechnical is not clear. Understanding this relationship (or lack thereof) is important for surgical educators. For example, if nontechnical skills are highly correlated to technical skills, one could argue that assessing for one or the other suffices, thereby relieving educators of the burden of creating a comprehensive examination. If, on the other hand, technical skills and nontechnical skills are not correlated, the need for a comprehensive surgical examination is more compelling. To date, studies have shown inconsistent results, with some suggesting significant correlation,<sup>13,14</sup> whereas others demonstrating no correlation.<sup>15,16</sup>

Using 5-years' data from a comprehensive surgical skills examination from the University of Calgary, this study aims to describe the validity evidence for this examination and to assess for the relationship between technical and nontechnical skills.

## Methods

### Objective structured performance-related examination (OSPPE)

All surgical OSPPE at the University of Calgary, conducted between 2010 and 2014, inclusive are included in this study. The OSPPEs were constructed based up the results of our initial pilot studies from 2009,<sup>17,18</sup> and contained three parallel tracks of seven 15-minute stations (with one rest station and five minutes between stations). The total duration for the examination is 2.5 hours. Ethical approval for the conduct of the study was provided by the Conjoint Health Research Ethics Board at the University of Calgary (REB13-1263).

### Station development

Surgical tasks assessed at the OSPPE are based on the American College of Surgeons' Surgical Resident Skills Curriculum (Basic/Score Skills and Tasks).<sup>19</sup> These tasks were taught during the postgraduate year-1 Surgical Skills course,<sup>18</sup> and the examination was conducted approximately 2 weeks after the course. Surgical tasks were assessed using bench models, animal tissues, and hybrid simulations, as appropriate. Stations 1 to 6 assessed technical skills in conjunction with 2 additional CanMEDs nontechnical competencies (Table 1), such as Collaborator, Professional, Manager, and Communicator. Each of these nontechnical competencies was assessed in our study, as per expectations from the training program.<sup>20</sup> However, only two nontechnical competencies per station were assessed in our study as there is evidence to suggest that raters may only be able to rate 2 dimensions reliably.<sup>21,22</sup> Nontechnical competencies were assessed via the use of

**Table 1** Objective-structured performance-related examination stations and competencies assessed

Station	Competencies assessed	Station context
1. Prepping and draping	Medical expert*; collaborator; professional	Work with the OR nurse; teach a medical student on how to prep and drape; manage confidentiality issue
2. Abdominal wall closure	Medical expert*; collaborator; manager	Work with a distracted OR nurse
3. Excision of a skin lesion (lipoma)	Medical expert*; communicator; professional	Interact with a conscious patient
4. Central venous catheterization	Medical expert*; collaborator; manager	Work with a new nurse, for whom English was a second language
5. Tracheostomy	Medical expert*; collaborator; manager	Work with a stressed and "territorial" anesthesiologist
6. Chest tube insertion	Medical expert*; ommunicator; professional	Interact with a coworker and the patient's mother
7. Delivering bad news	Medical expert*; communicator; professional	Deliver bad news to patient's relative

OR = operating room.

\*Medical expert refers to the technical skills required for each station.

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